

Nutrition and Dairy Industry Benefits Associated With Promoting Lowfat Milk: Evidence From the 1989 CSFII

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The dairy industry spends about \$225 million each year promoting its products, but historically, it has resisted explicit promotion of lowfat milk. This study examines the potential nutritional and industry benefits associated with greater use of lowfat milk by the U.S. population. The 1989 Continuing Survey of Food Intakes by Individuals (CSFII) was used to examine the association between types of milk, intake of lipids and calcium, and quantity of milk consumed. Results show that compared with whole milk drinkers, lowfat milk drinkers obtain less fat, saturated fat, and cholesterol from milk. However, lowfat milk drinkers are more likely than their counterparts to exceed the recommended levels of fat and saturated fat from all food sources. Lowfat milk drinkers consumed one-third to one-half more milk on the recalled day than whole-milk drinkers consumed. These results are consistent with other evidence that the dairy industry may derive economic benefits from promoting lowfat milk; the nutritional benefits are less clear. Additional study is warranted in this area: the effects of milk type on milk intake and dietary substitutions. Nutrition education should continue to promote specific dietary changes within the context of the total diet.

For the past few decades, public-private partnerships have emerged as an important element of nutrition and public health strategies (14,17). Similarly, the Institute of Medicine has recommended the negotiation of such partnerships as an important part of national, State, and local efforts to improve the diets of the U.S. population (14). Voluntary partnerships are particularly attractive as a means for implementing national nutrition policy because of the size of the food industry, the intensity of its marketing strategies, and the limited degree to which government regulation and promotion can be applied in this

sector. The 5 A Day for Better Health Campaign is one example of such a partnership (9).

Unlike the 5 A Day Campaign that aligns nutrition objectives and industry objectives (i.e., both seek to promote greater consumption of fruits and vegetables), a perceived conflict exists between dairy industry objectives and nutrition objectives as they relate to dietary fat. Dairy foods (as a class) are relatively high in total and saturated fats, and they contribute a large share of these nutrients (as well as calcium) in the American diet. For instance, analysis of a national sample revealed that whole milk, natural and

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processed cheese, and lowfat milk (all types combined) contribute 33 percent of the saturated fats and 21 percent of total fats in the diets of 2- to 5-year-old children (15). The same study estimated that the average intakes of fat and saturated fats by these children could be reduced to 30 percent and 10 percent of calories, respectively (corresponding to the upper levels as recommended for individuals), if lower fat versions of these three product categories were adopted. Such estimates make dairy products an attractive target for nutrition education and behavior change programs, especially in light of the apparent simplicity of changing to lower fat versions of milk. Recent work by the Center for Science in the Public Interest confirms that it may be feasible to induce a substantial population-level shift toward 1-percent milk and skim milk through intensive community-based promotions (2).

At the time of the report on *Improving America's Diet and Health* (14), the Committee on Dietary Guidelines Implementation of the Food and Nutrition Board believed that the dairy industry had inadequately promoted lowfat versions of dairy products, citing concerns about product image, price incentives, and labeling definitions. Since then, a number of changes have occurred at the national level to reduce those concerns and create incentives for the industry to promote lowfat milk. These changes include marked reductions in the U.S. Department of Agriculture's (USDA) support prices for dairy producers, corresponding declines in government-held surpluses of butter and cheese, more export opportunities, intense competition in the beverage industry for low-calorie products, and redefinition of "lowfat" milk by the Food and Drug Administration (FDA) (11). The familiar "moustache"

advertisements for milk and related promotional materials (7) are indicators of this shift in marketing strategy at the national level.

Despite this encouraging trend in industry advertising at the national level, much more needs to be done at State and local levels where the majority of funds for dairy promotion are spent and where more intensive, innovative promotional work can occur. The industry currently issues a mandatory assessment ("check-off") against producers, representing 15 cents per 100 pounds of milk, one-third of which supports national promotional efforts; two-thirds supports State and local efforts. In 1993 this assessment generated about \$75 million for use at the national level and \$150 million for use at State and local levels. Most of these funds continue to be used for generic promotion programs, rather than lowfat promotion, despite evidence of diminishing returns in some markets (13) and differential effects on the sale of whole, lowfat, and skim milk (12).

This paper presents some findings on (1) the quantitative contribution of dairy products to the nutrient intakes of children and adults, with a special emphasis on fluid milk; and (2) the relationship between types of milk (whole vs. lowfat) and amount of milk consumed. The first of these results is needed to estimate the magnitude of the effect (on nutrient intake) that might be expected from lowfat milk promotion efforts. The second of these results is of great interest to the dairy industry, because of the industry's concern that promoting lowfat milk might decrease product sales. These analyses, together with interviews with members of dairy promotion boards, were undertaken at the request of the New York State Department of Health to identify opportunities for partnering with the

industry to promote lowfat milk. The results are described at greater length elsewhere (11).

Methods

This study uses data from the 1989 Continuing Survey of Food Intakes by Individuals (CSFII), a multistaged, stratified probability sample that is representative of the 48 contiguous States. The sample consisted of 4,876 respondents. Sample sizes for African Americans and Hispanics were too small for most age categories to provide separate analyses, hence results are presented for all groups combined. Race, age, income, education, and region are controlled for in multiple regression analyses. Sample weights were used in all analyses to make inferences to the general population of the 48 contiguous States.

Dietary data were collected using a 24-hour recall conducted in person by a trained interviewer. Two additional days of dietary data were collected by a food-record method, with no probing for portion sizes and methods of preparation. The two methods yielded significant differences in the estimate of the amount of milk consumed each day: data from the dietary records collected on the second and third days suggested lower intakes. The 24-hour recall data are used here; we believe the recall data more accurately represent actual consumption.

The CSFII data set contains codes for 422 dairy items, grouped for this analysis into an overall dairy category and seven subgroups: Milk, yogurt, milk drinks, ice cream, ice milk, frozen yogurt, and cheese. People who reported using more than one dairy product or type of milk on the recalled day are included in all applicable categories for the purpose of estimating the percentage of people

Table 1. Sample sizes and percent reporting¹ various types of milk, 1989 CSFII

Age and gender	Total n	Percent reporting					
		Any dairy	Any milk	Whole	2-percent	1-percent	Skim
Males							
1-5	324	93.2	81.6	34.1	37.6	— ²	—
6-11	299	91.9	82.6	47.6	37.6	—	—
12-15	114	95.7	81.3	27.0	42.7	—	—
16-18	120	75.6	68.7	24.8	34.3	—	—
19-24	146	80.7	51.7	27.5	17.4	—	—
25-44	600	74.1	56.3	21.3	23.9	3.1	8.0
45-64	328	73.9	53.2	22.1	18.2	3.6	9.3
65+	336	77.1	62.1	24.5	19.4	6.1	12.1
Females							
1-5	325	94.8	84.9	46.8	35.6	—	—
6-11	290	86.6	71.9	31.4	27.5	—	—
12-15	102	87.1	60.0	27.8	30.6	—	—
16-18	122	80.8	61.5	27.9	26.6	—	—
19-24	160	82.2	54.1	29.6	20.0	—	—
25-44	759	77.1	59.5	19.8	23.2	4.4	12.1
45-64	429	70.0	58.3	22.7	21.9	2.3	11.4
65+	422	85.6	71.6	25.9	27.6	5.7	12.4

¹Sample sizes refer to the number of observations in the data set; “percent reporting” cells reflect sample weights.

²Cells are blank when the sum of the 1-percent and skim columns is less than 20 cases.

consuming a product. People not reporting the type of milk consumed were excluded from the analysis. Our paper focuses on fluid milk because of the interest in promoting lowfat versions of this product, which includes milk consumed as a beverage or as an easily recalled ingredient in some dishes (e.g., with breakfast cereal) but generally does not include milk used in more complex dishes (e.g., casseroles).

We used descriptive statistics to examine the percentage of respondents using any dairy product on the recalled day: Any type of milk; and whole, 2-percent, 1-percent, and skim milk. Because these categories are not mutually exclusive

and many respondents can report more than one category on a given day or in a 3-day period, the samples overlap. Thus such “cross-drinkers” are found in 12 percent of the adult female sample and 11 percent of the adult male sample, based on a subanalysis of the 3-day dietary data for each person. Cross-drinkers are included in some descriptive statistics (table 1) but are excluded from the regressions, which require that individuals be assigned to only one category of milk. Descriptive statistics are provided on the contribution of these dairy product categories to total fat, saturated fat, cholesterol, and calcium intake on the recalled day. The dietary data are com-

pared with the recommended levels of total fat (no more than 30 percent of calories), saturated fat (no more than 10 percent of calories), and cholesterol (no more than 300 milligrams) based on the Dietary Guidelines for Americans (16) and compared with the recommended levels of calcium based on the 1989 Recommended Dietary Allowances (8).

We use multiple regression to estimate the statistical effect of type of milk on milk intake while controlling for potential socioeconomic confounders. This analysis was conducted among 25- to 44-year-old adults for whom total sample sizes are greatest and the samples reporting

Whole milk and 2-percent milk are the more common forms consumed at all ages....

1-percent and skim milk are sufficient to support these analyses. Separate regressions were conducted to contrast whole milk with 2-percent, with 1-percent and skim combined, and with all lowfat versions combined (2-percent, 1-percent, and skim). The 1-percent and skim-milk drinkers were combined because of small sample sizes; they were analyzed only when at least 20 cases were in a given age/gender group to reduce the influence of random error on parameter estimates. Regression analyses were conducted with only those respondents who reported consuming any type of milk on the recalled day. Hence the results presented here refer to the portion of the population that consumes milk. All statistics were calculated with SAS (version 6), and proportional sample weights were used.

Results

About 70 to 96 percent of the sample reportedly consumed some type of dairy product on the recalled day (table 1). A somewhat lower percentage, 52 to 85 percent, reportedly consumed some type of fluid milk. Among milk drinkers, roughly half reportedly consumed whole milk, and most of the others reported drinking 2-percent milk. Whole milk and 2-percent milk are the more common forms consumed at all ages and are consumed by roughly similar proportions of the sample at each age. About 11 to 18 percent of respondents in the three oldest age categories (25 to 44, 45 to 64, and 65+) reported consuming 1-percent or skim milk on the recalled day, with skim milk being more common than 1-percent milk.

Whole milk provides 9 to 10 grams of total fat and about 6 grams of saturated fat for males and 6 to 9 grams of total fat and 4 to 6 grams of saturated fat for

females (table 2). This represents about 10 to 12 percent of total daily fat intake and 15 to 22 percent of saturated fat intake in most age/gender groups. (Results are not shown.) As expected, the quantity of fat and saturated fat provided by milk decreases considerably from whole milk to skim milk for all age/gender groups. Milk as a total category provides roughly half of the fat and saturated fat that comes from all dairy foods combined. (Results are not shown.)

The difference in fat and saturated fat intake across the four types of milk suggests that fat intake might be reduced if whole-milk drinkers switched to lower fat versions and did not start other dietary substitutions. Actually, the use of lower fat milks seems to be associated with considerable substitution, as shown in the "Pct>30%" and "Pct>10%" rows—the percentage of persons whose total fat and saturated fat intake (from all sources) was greater than recommended levels on the recalled day. Compared with the consistent gradient across the types of milk noted earlier, no consistent gradient is obvious in the percentage of respondents meeting the recommendations for fat and saturated fat. For instance, in five of the six age/gender groups, 2-percent milk drinkers exceed the recommendations for total fat and saturated fat by a higher percentage, compared with whole-milk drinkers. The same is true for the saturated fat recommendation. One-percent and skim-milk drinkers have values similar to or less than those for whole-milk drinkers in many age/gender groups.

The results for cholesterol follow a pattern similar to those for fat and saturated fat, with stepwise gradients in the quantity of cholesterol derived from milk, across the four types of milk and

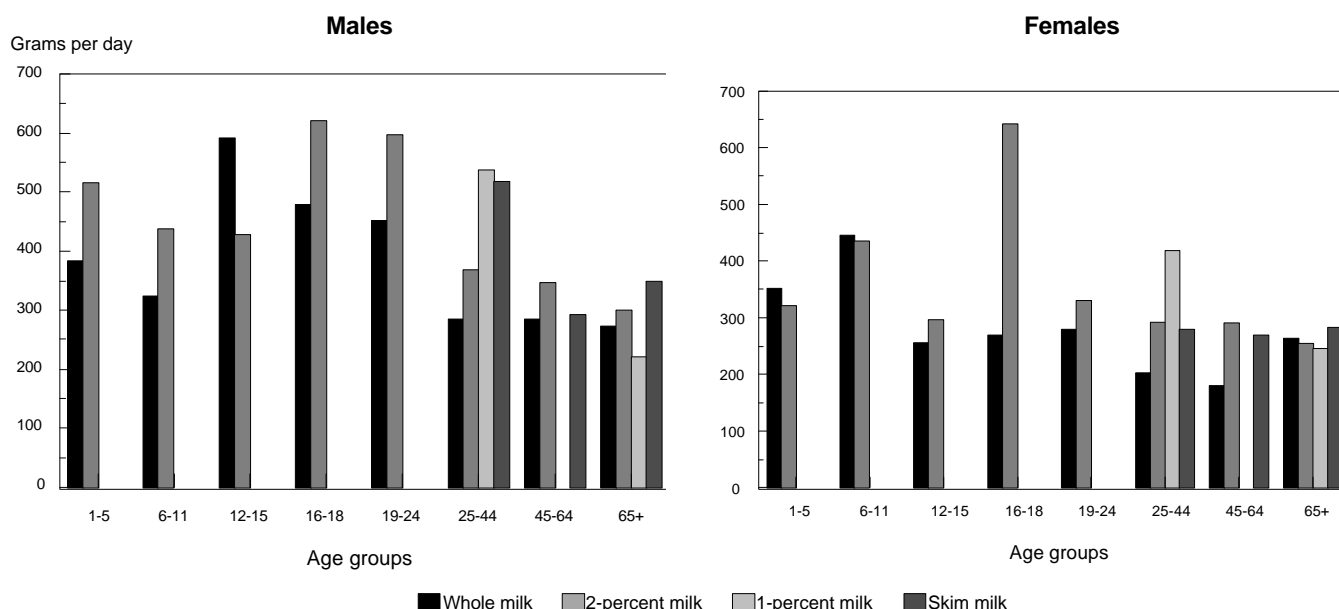
Table 2. Nutrient intake, by milk type, 1989 CSFII

Age and grams	Milk type consumed by males				Milk type consumed by females			
	Whole	2-percent	1-percent	Skim	Whole	2-percent	1-percent	Skim
Total fat								
25-44								
Grams	9.6	7.1	5.7	0.9	6.8	5.6	4.4	0.5
Pct>30% kcals ¹	73	66	87	55	63	65	76	70
45-64								
Grams	9.6	6.7	— ²	0.5	6.1	9.7	—	0.5
Pct>30% kcals ¹	51	73	—	85	72	76	—	68
65+								
Grams	9.2	5.8	2.3	0.6	8.8	5.0	2.5	0.5
Pct>30% kcals ¹	71	85	73	63	67	81	58	65
Saturated fat								
25-44								
Grams	6.0	4.4	3.6	0.6	4.2	3.5	2.8	0.3
Pct>10% kcals ¹	67	75	80	87	65	70	84	79
45-64								
Grams	6.0	4.2	—	0.3	3.8	5.6	—	0.3
Pct>10% kcals ¹	49	79	—	80	73	72	—	55
65+								
Grams	5.7	3.6	1.4	0.4	5.5	3.0	1.6	0.3
Pct>10% kcals ¹	76	82	67	62	58	81	57	71
Cholesterol								
25-44								
Grams	39	28	22	9	28	22	17	5
Pct>300 mg ¹	29	32	25	57	31	30	31	37
45-64								
Grams	39	26	—	5	25	22	—	5
Pct>300 mg ¹	14	11	—	6	16	12	—	6
65+								
Grams	37	22	9	6	36	19	10	5
Pct>300 mg ¹	31	19	20	33	27	43	15	27
Calcium								
25-44								
Grams	342	450	663	642	243	356	516	315
Pct<2/3 RDA ¹	34	41	52	39	37	47	48	38
45-64								
Grams	343	422	—	363	217	354	—	332
Pct<2/3 RDA ¹	36	40	—	40	32	40	—	43
65+								
Grams	328	365	270	427	315	310	300	349
Pct<2/3 RDA ¹	56	49	18	44	49	34	52	38

¹Percentage of respondents whose intake of nutrients from *all* food sources on the recall day did not meet the recommended level.

²Cells are blank when the sum of 1-percent and skim columns is less than 20 cases.

Milk intake, by milk type, 1989 CSFII



a less consistent gradient for percentage of persons exceeding the recommendation based on all foods consumed on the recalled day. The results for calcium show no consistent gradient across the types of milk consumed and age/gender groups, although there is a tendency toward higher calcium intakes among 1-percent and skim-milk drinkers, compared with whole-milk drinkers.

Is there a relationship between the type and amount of milk consumed? For all males except the 12 to 15 age groups, 2-percent milk drinkers report higher milk consumption on the recalled day than whole-milk drinkers reported (figure).¹ Among 25- to 44-year-old men, milk consumption is greatest among 1-percent drinkers and second highest among

skim-milk drinkers. There is no consistent relationship between milk type and quantity consumed for men 45 to 64 years or 65 years and older. Likewise, for females, there is no consistent relationship across the age groups, although the 25- to 44-year-olds who consumed lower fat versions of milk have consumed more grams of milk, compared with whole-milk drinkers.

Analysis of the characteristics of different milk drinkers revealed that lower fat milk is differentially consumed by older age groups, Whites (versus non-Whites), those with higher incomes, those living in the Northeastern United States, and those with more years of education (data not shown). For this reason, we used multiple regressions to examine the statistical effect of milk type on milk volume after controlling for these potential confounding factors (table 3).

The milk-type variable is positive and statistically significant for each of the three contrasts, for males as well as females.

The size of the difference between whole-milk drinkers and various lower fat milk drinkers is substantial (table 4). Compared with their intake of whole milk, males' intake of other types of milk is higher: 2-percent milk, 18 percent higher; 1-percent and skim milk, 102 percent higher; and 2-percent, 1-percent, and skim milk combined is 55 percent higher. The corresponding intake values for females are 58 percent, 75 percent, and 62 percent, respectively. In all cases, adjusting for socioeconomic differences across milk types leads to an *increase* in the effect estimates, rather than a decrease.

¹The 1-percent and skim-milk categories are omitted when the sample size is less than 20 for any given age group.

Table 3. Multiple regression equations testing the effect of milk type on milk volume while controlling for potential confounders (25- to 44-year-olds), 1989 CSFII

Gender and characteristics	Whole vs. lowfat ¹		Whole vs. 2-percent		Whole vs. 1-percent and skim	
	B	P-value	B	P-value	B	P-value
Males						
Age (years)	-14.00	0.0001	-11.35	0.0001	-10.33	0.002
Income (\$ x 1,000)	-0.12	0.08	-0.89	0.14	-0.28	0.003
Education (years)	-1.13	0.48	-0.51	0.68	0.66	0.78
Race (White vs. other)	108.94	0.02	73.33	0.04	89.11	0.10
Region (Northeast vs. other)	2.36	0.95	-202.24	0.0001	95.34	0.02
Milk type ²	170.16	0.0001	54.90	0.04	314.42	0.0001
Females						
Age	-3.00	0.05	-1.19	0.39	-3.25	0.12
Income	-0.66	0.08	-1.64	0.0001	0.05	0.92
Education	-0.60	0.63	-0.99	0.34	-1.56	0.41
Race	4.32	0.87	-22.75	0.28	-9.50	0.79
Region	-23.08	0.30	25.58	0.20	-61.88	0.04
Milk type ²	139.63	0.0001	129.63	0.0001	167.12	0.0001

¹Lowfat refers to 2-percent, 1-percent, and skim milk combined.

²Values indicate the difference (in grams) in consumption between whole-milk drinkers (reference group) and the lowfat categories. Positive values indicate greater consumption in lowfat categories.

Discussion

This paper provides empirical results that may help nutrition, public health, and dairy promotion board representatives evaluate the potential benefits of explicitly promoting lowfat milk. For nutrition and public health practitioners, it is important to know the contribution that milk consumption makes to total daily intake of key nutrients (fat, saturated fat, cholesterol, and calcium), the extent to which lowfat milk consumption affects that contribution, and the extent to which use of lower fat milks is associated with lower total fat and saturated fat intakes. For dairy promotion boards, it is important to know what effect, if any, promotion

of lowfat milk may have on total milk sales.

This paper reveals that, for most adult age/gender groups, whole milk provides about 6 to 10 grams of total dietary fat and 4 to 6 grams of saturated fats, compared with less than 1 gram of total fat or saturated fat for skim-milk drinkers. This represents roughly 10 to 12 percent of total fat and 15 to 22 percent of saturated fat in the daily diet. These figures suggest that we might expect a substantial reduction in daily fat and saturated fat intake if whole-milk drinkers switched to skim milk, used the same quantity of milk each day, and made no other dietary substitutions. This paper provides

evidence, however, that use of lower fat milks is associated with substantially higher volumes of intake among 25- to 44-year-olds (55 to 62 percent for all lowfat versions combined), representing a type of dietary substitution. This volume effect may offset some of the fat-related benefits of switching to lower fat milk but represents a positive finding with respect to calcium and other nutrients in milk. We also found that, compared with whole-milk drinkers, lowfat milk drinkers are as likely or even more likely to exceed the recommendations for dietary fat when all food sources are considered. Results suggest that dietary substitutions may negate some or all of

...the use of lower fat versions of milk is associated with greater intakes.

Table 4. Estimates of the effect of milk type on milk volume for 25- to 44-year-olds (adjusted consumption derived from regressions), 1989 CSFII

Gender and milk type	Observed consumption		Adjusted consumption	
	Grams consumed	Percent increase over whole milk	Grams consumed	Percent increase over whole milk
Males				
Whole	308	— ²	308	—
Lowfat ¹	411	33	478	55
2-percent	371	21	363	18
1-percent and skim	506	64	622	102
Females				
Whole	223	—	224	—
Lowfat	303	36	363	62
2-percent	299	34	353	58
1-percent and skim	310	39	390	75

¹Lowfat refers to 2-percent, 1-percent, and skim milk combined.

²Reference group.

the nutritional benefits of consuming lowfat milk.

We believe it is of interest that the percentage of fat, saturated fat, and cholesterol derived from cheese is similar to that provided by whole milk—among the 25 to 30 percent who report using cheese on the recalled day (11). Moreover, the percentage of these nutrients derived from pizza, among the 5 to 10 percent reporting pizza on the recalled day, is 3 to 5 times greater than the contribution from whole milk for those older than 20 years (11). However, cheese was reported by only about half as many people as those reporting milk; pizza was reported by an even smaller number of people. The results nonetheless indicate the potential for substitutions to negate or overcompensate for the

positive effects of lowfat milk consumption on total fat and saturated fat intake, even when the substitutions take place within the dairy category. U.S. milk supply data (macro level) provide further evidence of product substitutions; the sustained shift toward 2-percent milk since the mid-1970's has been accompanied by a 50-percent increase in cheese use (6), in part reflecting the growth in fast-food and prepared-food sectors.

One of the most provocative findings from this study, from the perspective of forming partnerships with dairy promotion boards, is this: the use of lower fat versions of milk is associated with greater intakes. This occurred in all age groups for males (except 12- to 15-year-olds) and in five of the seven age groups for females. Findings from the multiple

regressions suggest that among 25- to 44-year-olds (for whom sample sizes are adequate) this relationship is not due to confounding by socioeconomic factors: the magnitude of the statistical effect is *greater* after adjusting for potential confounders. The New York State Dietary Survey that used a food frequency instrument supports our findings (10,11). Similar results also are evident in 18- to 24-year-old women in the 1989-91 CSFII (4), women aged 18 and over in the 1990-91 CSFII (3), and in the community-based campaign by the Center for Science in the Public Interest (CSPI) (2). Significantly, the CSPI found that total milk sales rose by 15 percent in the month after the campaign and 25 percent 1 year later. Together, these results provide consistent evidence that an economic incentive may exist for the dairy industry to promote lowfat milk.

Several methodological limitations are relevant in making inferences about the potential effects of switching to lowfat milk on milk volume and on total daily intake. First, data in this study are cross-sectional and may reflect self-selection effects. That is, those now using lower fat milk may differ in many ways from those using whole milk, including the other dairy and nondairy components of their diets. And these traits may have preceded their switch to lowfat milk. Although the methods used here control for some of the potential confounding factors, they do not control for all potential confounding factors, and they do not address the possibility of reverse causality (i.e., that those with high fat intakes and/or high milk intakes may have switched to lowfat milk, rather than the switch in the type of milk causing an increase in milk intake). Longitudinal and experimental designs would provide more convincing evidence of the net

effects of switching to lower fat milk and associated substitutions.

Second, although dietary substitutions are a widely recognized class of behaviors (18), our approach for estimating substitutions relies upon examination of group-level data (table 2), rather than multiple regression. We used group-level data because of the inherent limitations of 24-hour recalls as estimates of habitual intake and substitutions. Using the 24-hour recalls in multiple regression analyses to investigate substitutions would likely lead to a large overestimate of the degree of substitution in the habitual diet. For example, most people are unlikely to consume milk, cheese, yogurt, cottage cheese, and ice cream all in 1 day, but all of these foods may be part of their habitual diet. Using group averages overcomes this problem but generates results that refer to group tendencies—not individual behavior.

Third, this study refers to milk drinkers' consumption patterns of 1989, which may differ from today's consumption patterns. Moreover, according to these analyses about 40 percent of 25- to 44-year-olds reported no milk consumption on the recalled day, roughly similar to the 30 percent seen in the full 1989-91 CSFII based on 3 days of observation for each subject (5). The factors associated with switching to lowfat milk and with the quantity of milk consumption may be quite different from the factors associated with the practice of consuming or not consuming milk habitually. Both sets of factors are of great interest—from an industry and a public health perspective—and are worthy of more detailed investigation using the more recent 1994-96 CSFII data. In particular, it would be instructive to apply econometric approaches to investigate these relationships and to address the limitations we noted

(1). This is relevant to note: the two-stage regression analysis of the 1989 CSFII data provided results similar to those reported here (11).

Our study provides evidence that the explicit promotion of lowfat milk may produce economic benefits for the dairy industry. Ironically, the nutritional benefits of such promotion (with respect to meeting the dietary fat recommendations) are less convincing in this study, because of the possibility of dietary substitutions. Additional studies of these substitution effects and milk volume effects are warranted, as is continued educational emphasis on the importance of the total diet. Practitioners may want to use these encouraging findings to initiate or strengthen their dialog with dairy promotion boards at the State and local levels, where two-thirds of the dairy industry's promotion dollars are spent.

Acknowledgments

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